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SPACE SUPPORT AT THE OPERATIONAL LEVEL:
HOW HAVE WE LEARNED THE LESSONS OF DESERT STORM?

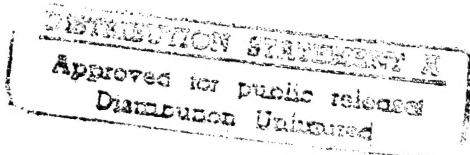
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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.



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19960501 208

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REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED			
2. Security Classification Authority:			
3. Declassification/Downgrading Schedule:			
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.			
5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT			
6. Office Symbol: C		7. Address: NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207	
8. Title (Include Security Classification): SPACE SUPPORT AT THE OPERATIONAL LEVEL: HOW HAVE WE LEARNED THE LESSONS OF DESERT STORM? (U)			
9. Personal Authors: THERESA M. PHILLIPS, <i>MAJ</i> , USAF			
10. Type of Report: FINAL		11. Date of Report: 12 February 1996	
12. Page Count: 25			
13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.			
14. Ten key words that relate to your paper: SPACE--FORCE ENHANCEMENT--USSPACECOM--SATELLITES--DOCTRINE--PLANNING--COMMUNICATIONS--NAVIGATION--INTELLIGENCE--OPERATIONS			
15. Abstract: While space support in Desert Storm was widely acclaimed, it also revealed a significant gap between the US military space and warfighting communities. Planning was done <i>ad hoc</i> . Doctrine was absent. Ground infrastructure to exploit the capabilities of space-based force enhancement, such as the Global Positioning System, was severely under-developed. These problems pointed to widespread deficiencies in educating the military-at-large on the contributions space has to offer to theater operations. US Space Command has taken the lead in improving space support to the warfighters, but a myriad of other military and government agencies actively participate in shaping how that support is planned for, allocated, and performed. A variety of new outreach programs provide the mechanism for ensuring coordinated and comprehensive education, training, exercise support, and planning assistance, tailored to the regional command's needs. However, the development of space operations doctrine is lagging well behind other initiatives. What is being considered for publication (proposed Joint Pub 3-14), lacks vision in exploiting space as one of the enabling elements of the emerging "system of systems." Timely, accurate, and reliable surveillance, warning, navigation, intelligence, and environmental data embedded in a secure communications and processing network can revolutionize a commander's situational awareness and battlefield dominance. The powerful force-multiplying effects of space force enhancement will best be realized if integrated into the overall joint operations battle management, command, control, communications, and information architecture.			
16. Distribution / Availability of Abstract:	Unclassified X	Same As Rpt	DTIC Users
17. Abstract Security Classification: UNCLASSIFIED			
18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT			
19. Telephone: 841- 6461 6461		20. Office Symbol: C	

Abstract of

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While space support in Desert Storm was widely acclaimed, it also revealed a significant gap between the U.S. military space and warfighting communities. Planning was done *ad hoc*. Doctrine was absent. Ground infrastructure to exploit the capabilities of space-based force enhancement, such as the Global Positioning System, was severely under-developed. These problems pointed to widespread deficiencies in educating the military-at-large on the contributions that space has to offer to theater operations. U.S. Space Command has taken the lead in improving space support to the warfighters, but a myriad of other military and government agencies actively participate in shaping how that support is planned for, allocated, and performed. A variety of new outreach programs provide the mechanism for ensuring coordinated and comprehensive education, training, exercise support, and planning assistance, tailored to each regional command's needs. However, the development of space operations doctrine is lagging well behind other initiatives. What is being considered for publication (proposed Joint Pub 3-14), lacks vision in exploiting space as one of the enabling elements of the emerging "system of systems." Timely, accurate, and reliable surveillance, warning, navigation, intelligence, and environmental data embedded in a secure communications and processing network can revolutionize a commander's situational awareness and battlefield dominance. The powerful force-multiplying effects of space force enhancement will best be realized if integrated into the overall joint operations battle management, command, control, communications, and information architecture.

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I. INTRODUCTION

Standing on the threshold of the 21st century, it may seem fitting to envision a reality in which combat action extends into outer space. Such "futuristic" thinking needs to take place if the United States is to someday exploit the full potential of the space arena. But given today's realities, it is premature to focus on the use of space as a combat environment. The post-Cold War threats and two major regional contingencies scenario, against which operational planning is being formulated, do not present a viable challenge to U.S. freedom of action in space. In addition, the Anti-Ballistic Missile treaty, signed in 1972, and long-standing U.S. policy that "activities in space should be devoted to peaceful purposes"¹ significantly restrict the development of offensive-minded space control or force application systems that would operate in space. The main focus should be, instead, improving and ensuring the integration and exploitation of force enhancement capabilities offered by today's space systems at all levels of military planning and operations.²

Desert Storm was proclaimed by many to be the first "space war," and a great deal of positive publicity was generated by the leverage space assets provided in prosecuting the war. Instead of resting on the laurels bestowed in the aftermath of victory, the military space community conducted a critical review of its role and performance during Desert Storm. Close examination of the successes and failures of space support to the warfighter revealed many shortcomings in how space assets were used during the conflict. An overall lack of planning meant assets were applied in an *ad hoc* manner. Little doctrinal guidance was available to shape operational thinking on how space support could influence the conduct of the war. The infrastructure to exploit the capabilities offered by key assets, such as the Global Positioning System (GPS), was not in place. Underlying all these issues was a fundamental lack of

appreciation of space systems and their capabilities by the warfighters. That a gap existed between the space community and military operators became glaringly obvious.

These lessons have provided the necessary impetus for making organizational, procedural, and doctrinal changes to improve the way space is viewed and used as an integral element of the U.S. warfighting arsenal. But change is never easy, and while positive strides are being made in this area, there is still a long way to go before the military can successfully claim to have mastered the full operational capability of existing space assets.

This paper examines progress being made to address the lessons of Desert Storm with respect to improving operational application of space assets in a force enhancement role. First, it reviews the space community's evolution and make-up. The vast number of disparate players involved in national space policy, systems acquisition, launch and satellite operations, and support to national security and military operations, have historically operated within very different cultures and had little interaction. Understanding the dynamics created by this history is key to overcoming the barriers that impede full exploitation of space in theater operations.

Second, this paper updates progress in bridging the gap between the space and warfighting communities in the 5 years since Desert Storm. Although the status will be, by definition, highly perishable, it provides a window into the roles and missions, and doctrinal debates currently underway. It also identifies the concrete steps being taken to institutionalize the assistance USSPACECOM and the service component commands provide to the warfighting Commanders-in-Chief (CINCs) in planning and executing their Operations Plans (OPLANs).

Finally, this paper provides an assessment of the current situation and recommendations for changing the way the U.S. military deals with space as an entity. While progress is being made, the military is not converging on an integrated approach that ensures seamless infusion of

space-based force enhancement into planning or operations. Doctrine is lagging rather than leading. Organizational impediments and residual parochialisms continue to detract from the goal of enlightening the CINCs to the full benefits of space. These problems stem from the way integration of space assets into military operations is being thought about and conducted. From a force enhancement perspective, space provides a vantage point for information collection and a medium for rapid dissemination that can significantly enhance a Joint Force Commander (JFC) or CINC's situational awareness and battlespace dominance. But its contributions cannot be viewed in isolation. The full potential of space support to the warfighter will be realized only if and when it is integrated into the overall joint operations architecture.

II. THE SPACE COMMUNITY

The evolution of military space operations and the role various services, organizations, and agencies have played in that evolution is a complex story. Beginning in the sixties, systems were developed and fielded in a disjoint fashion. System capabilities were identified and developed along functional needs, for example, to provide a communications conduit, rather than by area of operational exploitation, such as enhanced situational awareness (a process known as "stovepiping"). This established a paradigm that continues to dominate views about the use of space. It also prevented broader trade-offs or "system of systems" optimization from taking place.³ In spite of the high cost of developing, launching, maintaining, and utilizing space assets, no unifying strategy was provided or organizational hierarchy imposed to give direction or structure to the space community.⁴ The end of the Cold War, a dwindling pool of defense dollars, and the lessons of Desert Storm have stimulated a sorely needed re-examination of how to prioritize, manage, and apply space in support of military operations.

All the services have long-standing traditions of participation within the space community. The Air Force has had the largest role in system acquisition, space launch, and satellite operations, and controls over 90 percent of the military space budget and 80 percent of the personnel dedicated to space operations. But, the Army, Navy, and Marines have shared in these activities, and been active users of space collection and dissemination systems for more than three and a half decades.

The Air Force and Navy established "space commands" before the advent of the unified command. Air Force Space Command (AFSPC) was founded in 1982. Prior to then, acquisition and operation of space assets was done by Systems Command, and the emphasis was on operating the satellites, not on how they supported operational users. In 1993, the Air Force activated 14th AF (SPACEAF) as the "day-to-day manager of AFSPC space forces, including operations planning and force employment."⁵ SPACEAF controls the majority of military space systems, including GPS, the Defense Satellite Program (DSP) for missile warning, and the Milstar and Defense Satellite Communications System (DSCS) communications programs. Naval Space Command (NAVSPACECOM) was created in 1983. It operates the fleet support communications systems and TRANSIT navigation system.

USSPACECOM was formed by the Joint Chiefs of Staff in 1985 to "normalize the use of space in support of U.S. deterrence capabilities."⁶ It was assigned four missions: space force support, space force enhancement, space force application, and space force control. AFSPC and NAVSPACECOM became component commands at that time.

Army Space Command (ARSPACE) was activated in 1988 as the third component command of USSPACECOM. ARSPACE controls the DSCS payload and has the lead service role for Theater Missile Defense (TMD). It is responsible for integrating DSP in the TMD

battle management, command, control, communications, and intelligence architecture.

In addition to training, equipping, and supplying forces to USSPACECOM, each of the services administers a Tactical Exploitation of National Capabilities (TENCAP) program through their component command. USSPACECOM also has a TENCAP office. TENCAP has been in existence since the seventies, but is gaining mainstream attention as prototypes developed under its auspices begin to be fielded. TENCAP explores areas where operational use of the "National Systems" (a euphemistic term for intelligence-collection, a.k.a. reconnaissance, satellites) may have a significant impact. Current initiatives are in the areas of sensor-to-shooter, command and control (C2), mission planning, special operations, communications support, and enabling technologies.⁷

As product consumers and system managers other Department of Defense players, including Defense Mapping Agency (DMA), Defense Information Security Agency (DISA), and Defense Intelligence Agency (DIA), also have a long-term vested interest in the use of space assets in support of military operations. DMA provides the conduit for coordinating the use of commercial multi-spectral imagery products from LANDSAT. DISA is the central manager of communications assets allocation. DIA provides the bridge between the services and the larger intelligence community, including coordinating tasking of the National Systems.

Responsibility for control and use of the National Systems and derived intelligence products is divided among the National Reconnaissance Organization (NRO), Central Intelligence Agency, Central Imagery Office, and National Security Agency. Because the primary purpose of these systems is to support strategic-level national decision-making, insight into capabilities, and the ability to allocate tasking to military purposes, has historically been limited. The secrets of the NRO were so closely guarded that it was not even acknowledged as

an entity until after 1990. Promising progress is being made, however. A new emphasis on support to the warfighter is taking hold and the highly compartmented shroud of secrecy is slowly being lifted. In November 1995, for example, the fact that Signals Intelligence (SIGINT) is performed from space was released at the unclassified level. The national community has also established the Operational Support Office (OSO) as the coordinating body for training and exercise support to the services and regional CINCs.⁸ OSO works closely with the TENCAP offices to ensure an effective dialogue between the two worlds is achieved. Changes like this will greatly enhance the ability of operational planners to account for and exploit the capabilities of national assets.

The role of other government agencies, most notably the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA), has also greatly influenced the evolution of space operations. The most dramatic and costly example of NASA impacting the military space program was their successful lobbying for all military payloads to be launched via the space shuttle. After the Challenger accident it took many years and millions of dollars to recoup a military spacelift capability. NOAA has an ongoing role in environmental monitoring, including management of the LANDSAT program. In addition, the Defense Meteorological Satellite Program was recently merged with a NOAA counterpart, and responsibility for system acquisition and operations transferred to NOAA.

The above myriad of organizations involved in the military space program carry parochial interests, cultural bias, and roles and missions baggage which must be appreciated by the operational CINCs because they affect the way space assets are tasked. Progress is being made to alleviate these impediments, but fundamental C2 issues remain unresolved. USSPACECOM is assigned Combatant Command (COCOM) over military space assets and interprets that to

mean they are the CINC's single point of contact for space.⁹ But, they also recognize the difficulty in achieving such centralization when actual control of the various systems is based on the end use of the information being provided.¹⁰ Despite USSPACECOM efforts to act as the central coordination point for requirements and support to the warfighter, many legitimate as well as informal channels bypass them. Unless a total revamping of roles and missions is done, this situation is destined to continue. The impact on the warfighter can be minimized, however, by cooperation and unity of effort on the part of the space community.

III. CURRENT STATUS ON PROGRESS

As an outgrowth of Desert Storm and the shortcomings it revealed, USSPACECOM and its component commands have undertaken a wide range of measures to close the gap between the space community and U.S. warfighting forces. They recognize a lack of systematic education, training, OPLAN assistance, and an absence of unifying doctrine all contributed to the disconnect, and have been attacking the problem on each of these fronts.

One of the first issues was getting consistent and accurate information on the use and capabilities which space systems afford to the supported CINCs. The large number of different systems and their technical complexity made it necessary to compile all the information into a centrally prepared and controlled document. Thus, was born the Warfighter's Space Systems Handbook, which is updated annually, and describes in a concise manner the capabilities of the satellite systems and the user receive and processing equipment available for fielding in theater. It provides a good deal of information on the technical aspects of the various systems, and covers the tasking mechanisms for environmental, weather, intelligence, and communications support, including non-military programs such as LANDSAT. One weakness is it does not

address how to task the National Systems. It also provides very little in the way of doctrinal insight into how the catalog of systems it describes could be effectively employed or integrated at the theater level. For example, the handbook features over 40 different Tactical Data Processors (TDPs). TDPs run the gamut from receiving, storing, processing, displaying, and/or transmitting operational and intelligence data. As the handbook states, "These devices can process a wide variety of information, including SIGINT, imagery, image maps and weather information, and perform mission planning functions."¹¹ While selecting the right combination of TDPs is included in the planning process, more information into their benefits and use should accompany the system descriptions. That would give the handbook more operational emphasis, and make it more useful as a stand-alone document for a CINC's planning staff.

In parallel with handbook development, USSPACECOM has begun to gather and organize a wide range of assistance programs which have grown up in isolation from one another. They now advertise all space support services under the umbrella of a coherent outreach program. This program couples USSPACECOM activities with the service component programs and is structured to provide comprehensive information, support, and assistance to warfighting CINC's and their component commands. The outreach program includes "liaison officers, exercise participation, wargame support, space simulation and model support, TENCAP assistance, OPLAN development assistance, education and training for CINC staffs and the deployment of space support teams to assist during theater operations and exercises."¹²

The cornerstone of implementing this outreach is the Joint Space Support Teams (JSSTs) which provide on-site expertise during training, exercises, and contingency actions. There is a separate JSST for each regional command. At the core of each team are two permanently assigned USSPACECOM/J3 personnel supported and augmented by experts from the various

space operations disciplines.¹³ Each team is tailored to the needs of their specific geographic CINC and members are dedicated to a given theater. This allows them to be fully attune to the unique demands and constraints confronting the theater CINC. The teams deploy to the theater an average of 150 days per year.¹⁴ This helps them develop a rapport with the CINC's planning staff, and greatly enhances their effectiveness in fashioning a space support plan to address the theater's needs. USSPACECOM makes a point of noting that the permanent members of the JSSTs are not from the space community. Senior officers (O-5s and O-6s) with operator backgrounds are trained on space systems, rather than the other way around.¹⁵ The belief is this facilitates communication and enhances credibility with the theater staffs.

In addition to the JSSTs, each of the service components have Space Support Teams (SSTs) to support their counterparts in the regional commands. NAVSPACECOM sends Navy and Marine Corps SSTs to fleet and fleet Marine units for education and training on the use of space assets, prior to deployments.¹⁶ The teams spend up to 180 days explaining the capabilities and limitations of space assets and the products available from shipborne processing systems. The Air Force has Forward Space Support Teams which deploy on direction from SPACEAF and are "chopped" to the Air Force Component Commanders.¹⁷ Their teams have five personnel dedicated to each theater. The teams specialize in a geographic area; "giving them a current working knowledge of that region's specific needs and problems, as well as of what space assets are available should the U.S. have a military requirement there."¹⁸ The Army SST provides support to Army contingency operations by maintaining a core of 13 space specialists, deployable within 48 hours.¹⁹

All SST efforts are done in coordination with JSST activities. This was not the case until 2 years ago.²⁰ USSPACECOM has recognized the need to orchestrate the process in order to

ensure consistency of information and minimize the confusion this multitude of support teams creates for warfighters. As part of the consolidation effort, USSPACECOM is working closely with OSO to integrate support from the national community into the program.

USSPACECOM is also very involved in the Air Force's Space Warfare Center (SWC) activities. SWC was created by AFSPC in 1993 in direct response to deficiencies identified during Desert Storm. Its purpose is "to develop concepts, doctrines and tactics and to train space warriors about the requirements of the terrestrial warfighter."²¹ SWC supports all Air Force commands and coordinates with ARSPACE, NAVSPACECOM, and USSPACECOM in an effort "to improve both the understanding of space assets by field commanders and the transmission of information to them."²² To realize this goal, SWC runs a Space Tactics Instructors Course to prepare officers "to make best use of space assets in combat and pass that training on to others."²³ SST members attend the 3 month training program prior to deploying to the field. USSPACECOM recently investigated transitioning SWC to a joint activity, but a lack of joint billets and cost considerations forced the plan to be abandoned.²⁴

The most recent developments devoted to tightening the bond between warfighters and space operators occurred in late 1995. SPACEAF activated a Space Operations Center (SOC) at Vandenberg AFB in November 1995, as a part of a larger effort to provide 24-hour-a-day support to the CINCs.²⁵ The SOC will provide a direct feed on the status of all SPACEAF controlled space assets. Its efforts are being integrated into a joint space operations control network. Centralized monitoring of all military space assets will be done from the Joint Space Operations Center (SPOC), which "stood up" on 1 December 1995 in Colorado Springs, and has an anticipated full operational capability in the summer of 1996. The goal is to develop the capability to assess and inform the regional CINCs of the impacts of space system anomalies to

their theater, i.e., to translate system status into what it means to them at the operational level.²⁶ Other planned nodes in the network will include the Army, Navy, OSO, and the Joint Staff J2.²⁷

The next area USSPACECOM is tackling is providing better tools to the theater to assist in the planning process. They have just developed a prototype system called Theater Support Operations Cell (TSOC) which provides visual representations of all U.S. military and intelligence satellite constellations in orbit and their dynamic coverage zones as they map down to an area of interest. TSOC also creates a timeline which depicts how the coverage opportunities for each of the systems overlay in a specific geographic location. In addition, it shows how GPS navigation accuracy changes as a function of time. This information could prove invaluable in planning coordinated actions, by ensuring communications, navigation, intelligence and environmental data collection assets sync up to fully support operations.²⁸

The larger issue of deliberate planning cannot be solved using TSOC alone. The process of deriving theater space force enhancement requirements and documenting them in Annex N of an OPLAN takes a great deal of close coordination between the space community and the CINC's J2, J3 and J6 planning staff. One of the primary purposes of the USSPACECOM outreach program is to educate the warfighters and establish the links that make such coordination possible. Before the release of the latest Joint Strategic Capabilities Plan, an Annex N and its associated support plan had been prepared for each of the regional CINC's OPLANs. With the requirement for OPLANs being reduced and the emphasis being placed on CONPLANs, USSPACECOM is considering whether or not to develop support plans for each CONPLAN.²⁹ Although the support plans are no longer required, the inclination is to go ahead and prepare them. Because the lead times for coordinating communications assets allocation, and for identifying and procuring critical infrastructure such as TDPs and GPS receivers is so

great, it is imperative this planning take place.

Progress in institutionalizing the relationship between the space community and the warfighters is encouraging. Better understanding of space systems capabilities and closer coordination in planning for their application are essential steps in this process. Unfortunately, in the area of doctrine, concrete milestones are harder to identify. Work on joint space doctrine has been going on for over 5 years, but Joint Publication 3-14, Joint Doctrine; Tactics, Techniques, and Procedures for Space Operations is still in draft. The latest copy available for review is dated 1 September 1994. An updated version was recently sent to the Joint Staff after being held up in internal review at USSPACECOM over issues in the space control area.³⁰ In the absence of agreed-to doctrine, training and planning have tended to focus on the technical aspects of space systems utilization, rather than promote innovative thinking about how to leverage these systems in joint operations.

Even more distressing than the great tardiness of published joint doctrine, is the fact that what is being considered for release has so little true doctrinal value. The 1994 draft of Joint Pub 3-14 holds out the promise that it will "link the unique operating medium of space with the principles of war" and establish "a common way of thinking about the integration of military space operations into joint campaigns, operations and tactics."³¹ While it hints at this linkage in a variety of spots, it does not provide a unifying framework for exploiting space assets at the operational level of war. First off, it contains a great deal of superfluous information from the warfighter's perspective. One section is devoted to discussing the considerations of space as an operating media. This is of vital importance if you are responsible for the on-orbit health and maintenance of a satellite, but it is of little practical value to a JFC or his staff. Second, while it provides a wealth of useful information on the procedures for tasking various systems, it is the

wrong place to capture the material. A great deal is redundant to the Warfighter's Space System Handbook which is a more appropriate place to consolidate this type of data. Overloading the document with so much information dilutes its impact and makes it very difficult to pull out the ideas of merit and doctrinal insight.

Imbedded in the middle of Joint Pub 3-14 is section III, which touches on doctrine and could provide a fruitful starting point for a more developed discussion. It discriminates between space system functions which provide a capability, such as communications, and military space operations which "encompass both that capability and its use by joint forces."³² It then enumerates 4 types of military space operations: space combat support, space fire support, counterspace operations, and space operations mission support. Under combat support (read force enhancement), the document discusses how space assets can reduce a commander's uncertainty, assist in command and control, and moderate the effects of friction. This is the most promising section of Joint Pub 3-14, but there is still much room for improvement. The benefits of GPS, for example, are barely touched upon. The discussion acknowledges GPS's contribution to maneuver, but how it could be exploited to maintain ops tempo, synchronize operations, or enhance situational awareness is not even noted.³³

Meanwhile, the services continue to promulgate their views in various writings and doctrinal publications. Excellent work is available for the joint world to draw from, except it is often clouded by the roles and missions debate.³⁴ Air Force Doctrine Directive-4 (AFDD-4), Space Operations Doctrine, for example, does an insightful job of looking at space force enhancement from an integrated perspective. It doesn't go system-by-system and discuss capabilities, instead, it looks at space support at the campaign level, as well as for air, land, maritime, and special operations. It organizes the discussion around themes such as preparing

the battlefield, enhancing situational awareness, and controlling the timing and tempo of operations. This approach is more in line with how joint doctrine should be constructed. On the down side, however, AFDD-4's emphasis is on how "integrated air and space forces accomplish their theater-level objectives."³⁵ This is consistent with the Air Force mission "to defend the United States through control and exploitation of air and space"³⁶ and their desire to be the lead service in integrating space into joint military operations.³⁷ Joint Pub 3-14 would be vastly improved if it were to borrow liberally from AFDD-4. The danger is misplaced pride of authorship or resistance to what is seen as the Air Force's self-serving agenda will prevent people from absorbing the valuable insights AFDD-4 has to offer.

VI. ASSESSMENT AND RECOMMENDATIONS

The difficulty in putting out a coordinated and approved joint doctrine is reflective of a larger issue. In spite of 5 years of progress, there is still a lack of consensus on the direction space support to the warfighter should take. Literature on the subject reflects a state of flux and uncertainty with ideas being floated from one extreme to another. Some advocate a separate space force, or consolidating all space support in a Joint Force Space Component Commander, akin to the Joint Force Air Component Commander.³⁸ At the other end of the spectrum are organizations desiring to retain control of space systems as organic assets for their service.³⁹ Everyone wants to stake out positions of influence and control in what is seen as the key to tomorrow's battlespace dominance.

The space community's heightened attention to the warfighters, however well-intentioned, has been a source of confusion as well.⁴⁰ USSPACECOM steps to consolidate and coordinate the efforts of the various services should eliminate this problem, but it will not eliminate the fact

that there is still no agree-on joint doctrine for space operations.

Interestingly, the theater CINC's are staying quiet during this debate. They should be leading the way in the formulation of joint space operations doctrine and in devising new and creative ways to apply space system capabilities as a force multiplier. In contrast, the individual services have been quite vocal in their views of how to best integrate and/or distribute the use of space assets in support of land, air, or sea operations.

The crux of the problem is the direction the space community is taking to attack the gap between themselves and the warfighting forces. They are approaching the issue of how to integrate space in a force enhancement role exactly opposite from how it should be done. They try to treat space as a monolithic entity and ask how it can be used to support the CINCs. Instead they should be looking at joint military operations as the unifying framework. The focus needs to be on the integration of forces executing a synchronized, seamless set of reinforcing actions throughout the battlespace. Only then should doctrine and mission/function/resource allocations, which optimize the effectiveness and efficiency of operations, be assessed. In turn, the requirements for space systems as they fit into an overall theater architecture can be derived and the role they play determined. This is not to say USSPACECOM's efforts at education, training, and exercise support are unnecessary. They are imperative, as is the continued interaction between USSPACECOM and the joint operations planners in developing theater OPLANs, CONPLANs, and Annex Ns. Investment in the TENCAP program is equally important. These efforts should continue, but they need to be viewed in a new light, and placed into a larger context than space alone.

Admiral Owens's approach towards future force planning using the "Systems of Systems" construct provides a useful model for transparently fusing space force enhancement capabilities

into the joint arena.⁴¹ Space systems play a key role in all three of the broadly defined areas of technology in the Admiral's framework: intelligence, surveillance and reconnaissance; advanced command, control, communications, computers, and intelligence (Advanced C4I); and precision-guided munitions. While the Admiral's uses his thesis to establish a signpost to the future, it is equally valid for re-thinking today's military. When space is treated as a realm separate from intelligence, or C4I, or how to get bombs on target, the powerful synthesizing benefit of jointness is sacrificed. The leverage provided by space assets will be realized only if doctrine on space operations is fully integrated into the "Revolution in Military Affairs" which is changing the fundamental way the U.S. conducts military operations.

It is interesting to note how the intelligence and C4I communities are confronting the same issue. "C4I for the Warrior" and joint intelligence initiatives mirror many of the steps being taken by the space community.⁴² Combining the efforts of these mutually supportive disciplines would greatly leverage the effectiveness of joint warfare.

V. CONCLUSION

Being knowledgeable about space systems and what they add to the warfighting mix is critical for today's operational commanders. Space assets provide precise, reliable, and accurate surveillance, navigation, intelligence, and environmental data in near-real-time. Properly exploited, these capabilities enable a CINC or JFC to achieve a new level of situational awareness, and to effectively synchronize and coordinate forces. They greatly facilitate mobility, maneuver, and the application of fire. This, in turn, allows forces to maintain an ops tempo which keeps the enemy off balance, upsets his decision cycle, and undermines his ability to respond to offensive initiative.

The space community has taken a number of positive steps to advance U.S. warfighters' ability to appreciate and apply these benefits. USSPACECOM's comprehensive outreach program is an effective vehicle for education and training in the capabilities, tasking mechanisms, and planning considerations for effective use of space. The Joint Space Support Teams and their service counterparts have achieved an important rapport with the theater planning staffs. Centrally monitoring and evaluating system status 24-hours-a-day increases the readiness and responsiveness of space assets to operational users. Tools such as the TSOC make understanding and planning for integrated support of space assets in operations much easier. Closer coordination with the national systems, coupled with the expanded TENCAP program, means faster, fuller exploitation of intelligence directly into the theater.

Despite all this progress, problems remain. The plethora of players in the space arena and their continuing roles and missions debate detract from focusing on end-user needs. The lack of agreement on joint doctrine for space-based force enhancement significantly reduces the chances of optimal exploitation of these assets. The current approach to thinking about space as a defining entity artificially constrains its use. Considering space support on a system-by-system basis, especially while the military is trying to come up with a new paradigm for how to fight in a truly joint environment, ignores the powerful synthesizing potential of these systems.

While satellites operate in the vacuum of space, they cannot enhance military operations if they are treated in a vacuum. To truly optimize their support, they must be integrated into a cohesive command and control, information, and communications architecture. Diffusing space support throughout the emerging "system of systems" may make its force enhancement contributions less apparent, but it will increase them manifold.

ENDNOTES

¹ _____. "Legal Principles Relevant to Military Activities in Outer Space," reprinted from U.S. Department of the Air Force, Office of the General Council, letter, 3 February 1992, 59.

² The six functional areas which provide force enhancement from space are surveillance, early warning, communications, navigation, environmental data (including mapping and weather), and intelligence.

³ Dana J. Johnson and others, Space Roles, Missions, and Functions: The Challenge of Organizational Reform, PM-382-CRMAF, (n.p.: Rand, August 1995), 7.

⁴ Ibid., 9.

⁵ U.S. Space Command, On Orbit brochure (n.p., n.d.), 16.

⁶ Ibid., 4.

⁷ David B. Lynch, "Spacepower Comes to the Squadron," Air Force Magazine, September 1994, 70.

⁸ William A. Ross, "Space Support to the Warfighter," Military Intelligence, January-March 1995, 53.

⁹ Col Ken Riley, "USSPACECOM Overview," Briefing, U.S. Naval War College, Newport, RI: 25 January 1996.

¹⁰ Joint Chiefs of Staff Proposed Pub 3-14, Joint Doctrine: Tactics, Techniques, and Procedures for Space Operations. (Washington: 1 September 1994), V-9.

¹¹ U.S. Space Command, Warfighter's Space Systems Handbook, (Peterson Air Force Base, CO: 30 September 1994), 4-1.

¹² Ibid., B-1.

¹³ Telephone conversation with Major Jan Weber, USSPACECOM/J33, Peterson Air Force Base, Colorado Springs, CO, 15 December 1995.

¹⁴ Telephone conversation with Lt Cmdr Theresa Robinson, USSPACECOM/J33, Peterson Air Force Base, Colorado Springs, CO, 18 December 1995.

¹⁵ Col Riley briefing, 25 January 1996.

¹⁶ Cmdr Craig Baldwin, "NAVY SPACE COMMAND Overview," Briefing, U.S. Naval War College, Newport, RI: 1 February 1996.

¹⁷ U.S. Space Command/J33Y, "Command & Control Warfare," Briefing handout, n.d.

¹⁸ J. R. Wilson, "A Commanding View," International Defense Review, January 1995, 22.

¹⁹ U.S. Space Command, "Command & Control Warfare," Briefing handout.

²⁰ Col Ken Riley briefing, 25 January 1995.

²¹ J. R. Wilson, 24.

²² Ibid., 22.

²³ Ibid.

²⁴ Interview with Col Ken Riley, USSPACECOM/J33, Peterson Air Force Base, Colorado Springs, CO: 25 January 1995.

²⁵ Telephone conversation with Lt Cmdr Theresa Robinson, 18 December 1995.

²⁶ Interview with Col Riley, 25 January 1995.

²⁷ Ibid.

²⁸ TSOC demonstration by Col Ken Riley in the Space Operations Elective Course, U.S. Naval War College, Newport, RI: 25 January 1995.

²⁹ Interview with Col Riley, 25 January 1995.

³⁰ Ibid.

³¹ Joint Pub 3-14, I-1.

³² Ibid., III-4.

³³ Ibid., III-14.

³⁴ See, for example, William J. Toti, "Who Need Space Command?" U.S. Naval Institute Proceedings, April 1995. Note the confrontational tone of the article which detracts from some very constructive suggestions about the future direction of space.

³⁵ U.S. Air Force Doctrine Directive-4, "Space Operations Doctrine," as reprinted in "Supporting the Warfighter: General Support to Full Dimension Operations," Space Campaign Course Book, (Air Command and Staff College, Maxwell Air Force Base, AL: n.d.) 77.

³⁶ "Air Force Space Policy," Space Campaign Course Book, (Air Command and Staff College, Maxwell Air Force Base, AL, n.d.) 62.

³⁷ Ibid.

³⁸ Ricky B. Kelly, "Centralized Control of Space: The Use of Space Forces by a Joint Force Commander," Unpublished Research Paper, Air Command and Staff College, Maxwell AFB, AL: 22 September 1994.; Charles A. Horner, "Space Systems Pivotal to Modern Warfare," Defense 94, 20-29.

³⁹ Sandra I. Meadows, "Coherent Space Programs Aim of Joint Service Push," National Defense, January 1995, 12.

⁴⁰ Dana J. Johnson and others, 42.

⁴¹ William A. Owens, "The Emerging System of Systems," U.S. Naval Institute Proceedings, May 1995, 36.

⁴² "C4I For The Warrior, Global Command and Control System, From Concept to Reality", J6I brochure, 12 June 1994; "Joint Intelligence and Uphold Democracy", Joint Forces Quarterly, Spring 1995, 56.

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